UNIVERSITI TEKNOLOGI MALAYSIA

Assignment-1

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- **Question 1: Let the universal set be the set R of all real numbers and let**

A={x∈R | 0 < x ≤ 2}, B={x∈R | 1 ≤ x < 4} and C={x∈R | 3 ≤ x < 9}. Find each of the following:

A={x∈R | 0 < x ≤ 2} = (1,2)

B={x∈R | 1 ≤ x < 4} = (1,2,3)

C={x∈R | 3 ≤ x < 9} = (3,4,5,6,7,8)

- a) A ∪ C = (1,2) ∪ (3,4,5,6,7,8)

= (1,2,3,4,5,6,7,8)

- b) (A ∪ B)′ = ((1,2) ∪ (1,2,3))′

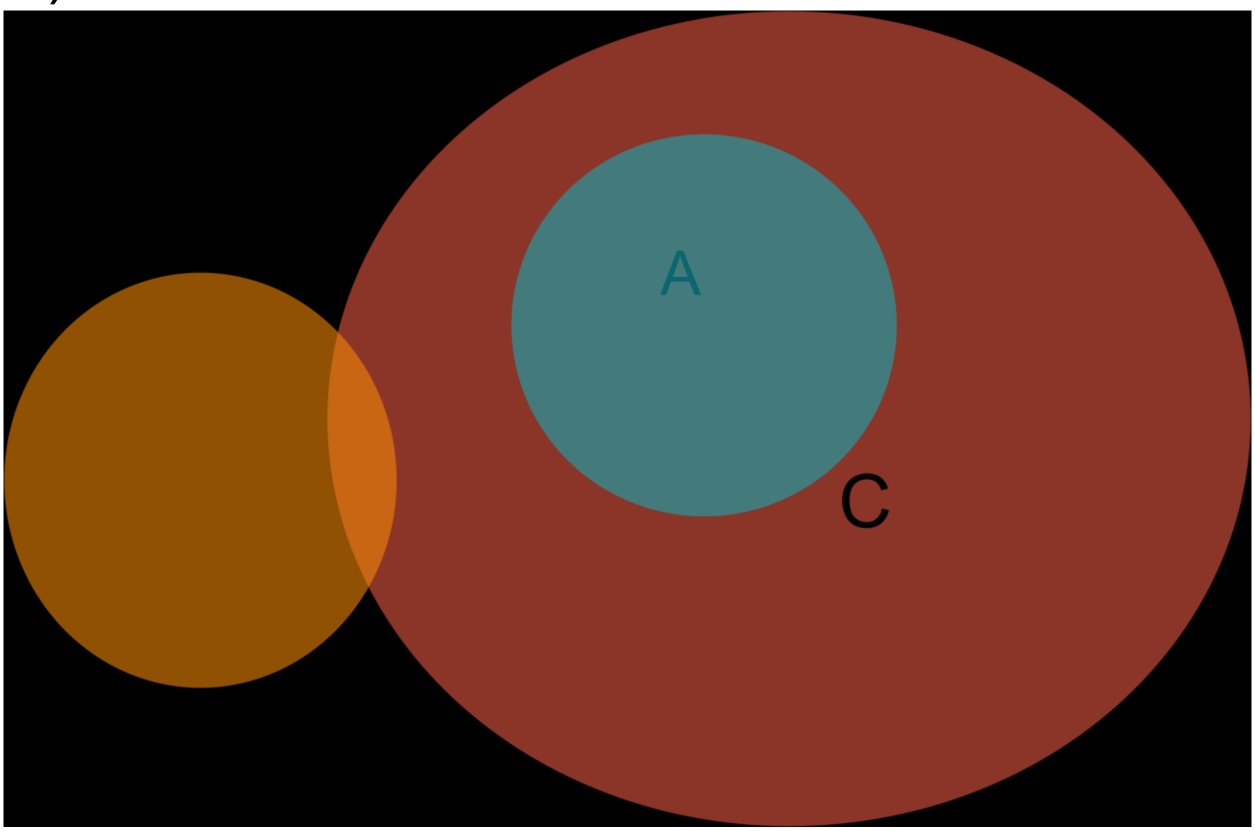
= (1,2,3) ′ = {x∈R | x < 1 & x > 3}

- c) A′ ∪ B′ = (1,2)′ ∪ (1,2,3)′

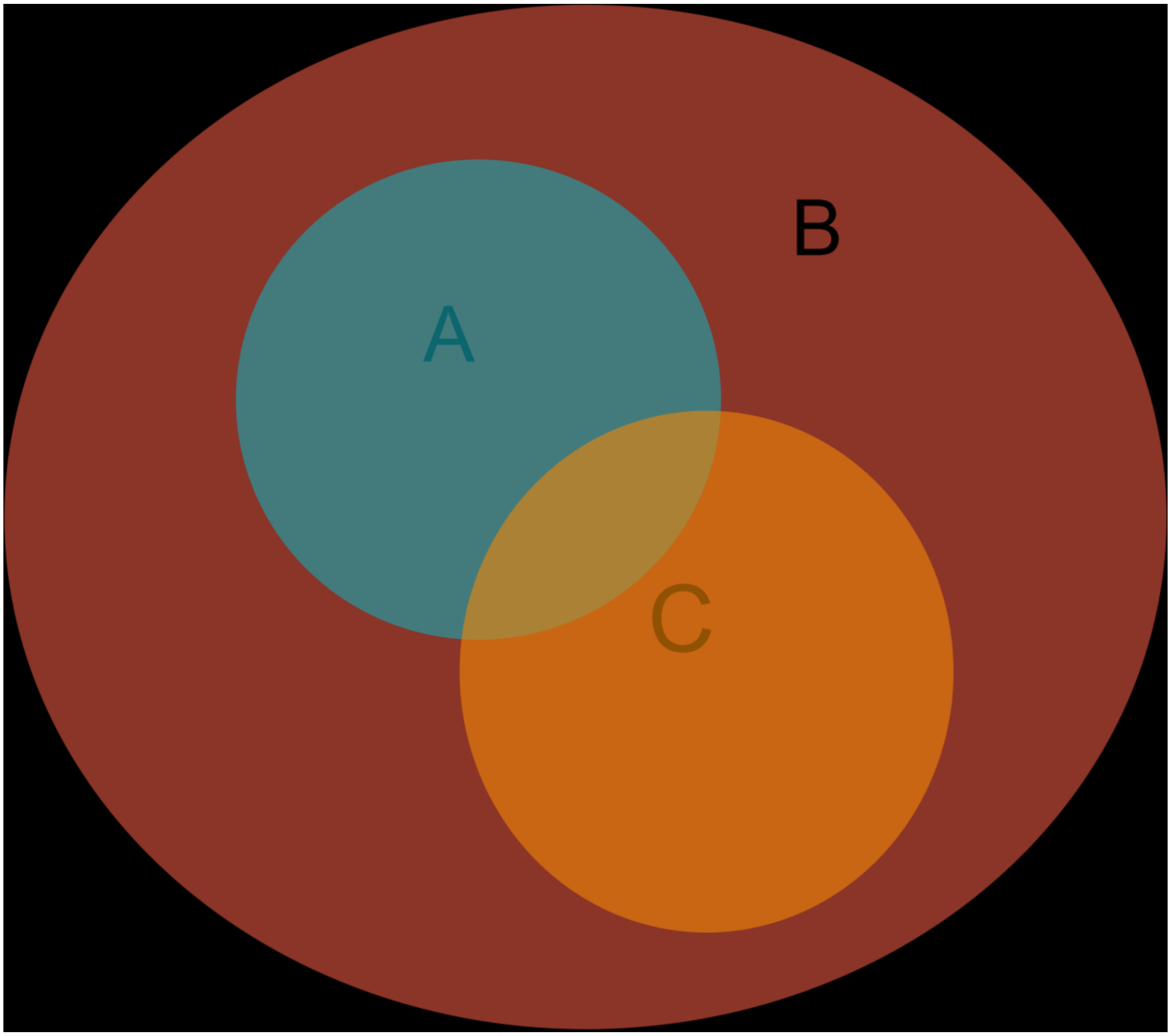
= {x∈R | x < 1 & x > 2} ∪ {x∈R | x <1 & x >3}
= {x∈R | x < 1 & x > 3}.

- Question 2: Draw Venn diagrams to describe sets A, B, and C that satisfy the given conditions:

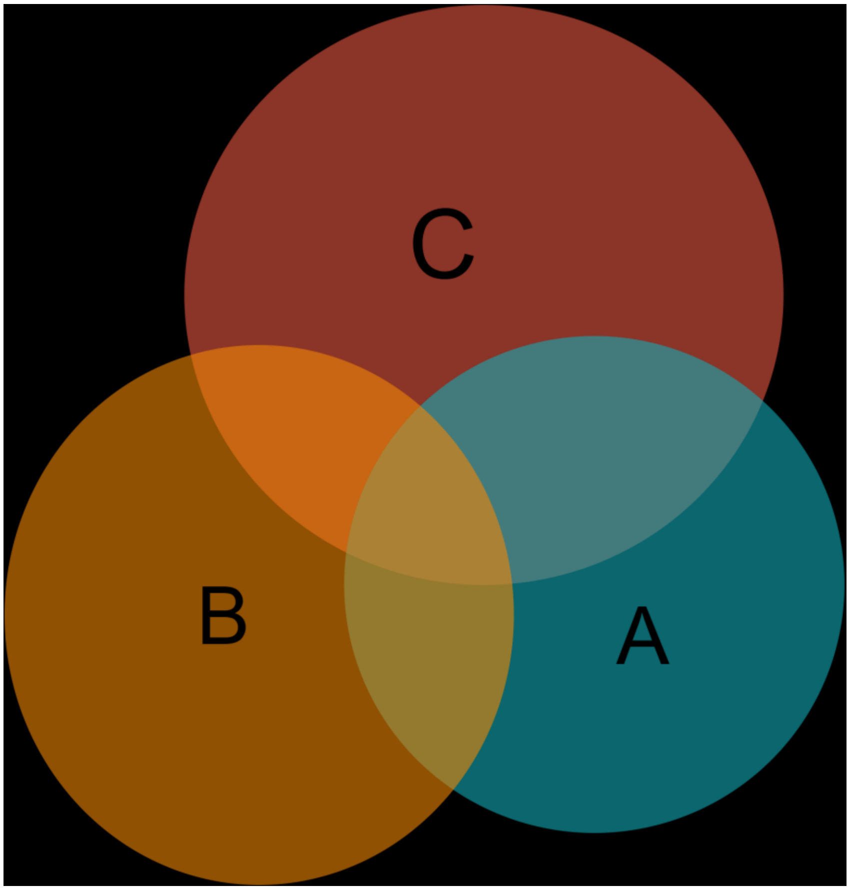
A) $A \cap B = \emptyset$, $A \subseteq C$, $C \cap B \neq \emptyset$



B) $A \subseteq B$, $C \subseteq B$, $A \cap C \neq \emptyset$



C) $A \cap B \neq \emptyset$, $B \cap C \neq \emptyset$, $A \cap C = \emptyset$, $A \not\subset B$, $C \not\subset B$



Question 3: Given two relations S and T from A to B,

- $S \cap T = \{(x,y) \in A \times B \mid (x,y) \in S \text{ and } (x,y) \in T\}$

- $S \cup T = \{(x,y) \in A\times B \mid (x,y) \in S \text{ or } (x,y) \in T\}$

- Let A= {−1, 1, 2, 4} and B= {1,2} and defined binary relations S and T from A to B as follows:

- For all $(x,y) \in A\times B$, $x\ S\ y \leftrightarrow |x| = |y|$

- For all $(x,y) \in A\times B$, $x\ T\ y \leftrightarrow x - y$ is even

- State explicitly which ordered pairs are in A×B, S, T, $S \cap T$, and $S \cup T$.

<u>Ans</u> = Here,

A×B = {(-1,1), (-1,2), (1,1) (1,2), (2,1), (2,2), (4,1), (4,2)}

S= {(-1,1), (1,1), (2,2)}

T= {(-1,1), (1,1), (2,2), (4,2)}

S ∩ T = {(-1,1), (1,1), (2,2)}

S ∪ T = {(-1,1), (-1,2), (1,1) (1,2), (2,1), (2,2), (4,1), (4,2)}

Discrete Group Assignment

4.

p	q	-p^q	-p^q	-((-p^q) v(-p^-q))	(p^q)	P
T	T	F	F	T	T	T

T	F	F	F	T	F	T
F	T	T	F	F	F	F
F	F	F	T	F	F	F

De Morgan’s Law

5. Ordering x, y, z : 1,2,3,4,5

R1={(x,y)|x+y<=6}

R1={(1,1); (1,2); (1,3); (1,4); (1,5); (2,1); (2,2); (2,3); (2,4); (3,1); (3,2); (3,3); (4,1); (4,2); (5,1)}

a) A1= 1 1 1 1 1 reflexive, symmetric,Transitive

1 1 1 1 0

1 1 1 0 0

1 1 0 0 0

1 0 0 0 0

R2={(x,y)|y>z}

R2={((2,1); (3,1); (3,2); (3,3); (4,1); (4,2); (4,3); (5,1)); (5,2)); (5,3)); (5,4)}

b)

A2= 0 0 0 0 0

1 0 0 0 0

1 1 1 0 0

1 1 1 0 0

1 1 1 1 0

c) yes it is. R1 is equivalent relation. (reflexive, symmetric, Transitive)

d) yes it is. R2 is Partial order relation. reflexive, asymmetric, Transitive)

6.

A1= 1 0 0 ; R1 ={(1,1); (2,2); (2,3) ; (3,1); (3,3)}

0 1 1

1 0 1

A2= 0 1 0 ; R2 = {(1,2); (2,2); (3,1); (3,3)}

0 1 0

1 0 1

a) Matrix of relation R1 U R2.

R1 U R2 = {(1,1); (1,2); (2,2); (2,3); (3,1); (3,3)}

R1 U R2 1 1 0

0 1 1

1 0 1

b) Matrix of relation R1 R2.

R1 Ç R2 = {(2,2); (3,1); (3,3)}

R1 Ç R2 0 0 0

0 1 0

1 0 1

7. If f :R→ R and g:R→ R are both one-to-one, is f + g also one-to-one?

Justify your answer.

- Answer :

If f(x) = x and g(x)=-x is one to one.

Ex :

f(1) = 1 g(1) = -1

f(2) = 2 g(2) = -2

Etc

But, is f+g also one to one?

(f+g): R→ R

(f+g)(x) = f(x) + g(x) for all real number is 0

Ex:

(f+g)(1) = f(1) + g(1)

= 1 + (-1) = 0

(f+g)(2) = f(2) + g(2)

= 2 + (-2) = 0

Etc

So, this shows that f+g is not one to one

8. With each step you take when climbing a staircase, you can move

up either one stair or two stairs. As a result, you can climb the entire staircase taking one stair at a time, taking two at a time, or taking a

combination of one- or two-stair increments. For each integer $n \geq 1$, if

the staircase consists of n stairs, let cn be the number of different

ways to climb the staircase. Find a recurrence relation for c1, c2, ….,cn.

Answer :

When n=1, c(1)=1

When n=2, c(2)=2

So its must greater than 1 or 2. When n>=3, the ways of climbing a staircase can

divided into two groups based on the last step taken is either a single stair or two

stairs together.

If the last step is a single stair, the number of ways is c(n-1). If the last step is two stairs together, there are c(n-2) ways. Therefore, c(n)=c(n-1)+c(n-2).

Result :

c(1) = 1

c(2) = 2

c(n) = c(n-1) + c(n-2) when n ≥ 3

9. The Tribonacci sequence (tn) is defined by the equations,

t0 = 0, t1 = t2 =1, tn = tn-1 + tn-2 + tn-3 for all n ≥ 3.

a) Find t7.

b) Write a recursive algorithm to compute tn, n ≥3.

Answer :

a) we start from t3

t3 = t3-1 + t3-2 + t3-3 = t2 + t1 + t0 = 1 + 1 + 0 = 2

t4 = t4-1 + t4-2 + t4-3 = t3 + t2 + t1 = 2 + 1 + 1 = 4

t5 = t5-1 + t5-2 + t5-3 = t4 + t3 + t2 = 4 + 2 + 1 = 7

t6 = t6-1 + t6-2 + t6-3 = t5 + t4 + t3 = 7 + 4 + 2 + = 13

t7 = t7-1 + t7-2 + t7-3 = t6 + t5 + t4 = 13 + 7 + 4 = 24

t7 = 24

b) //Fibonacci Series using Recursion

```
#include<bits/stdc++.h>
using namespace std;
int t(int n) t0 = 0, t1 = t2 = 1
{
if (n ≥ 3)
return n;
return t(n-1) + t(n-2) + t(n-3);
}
```